the slightest degree of sweetness in decoctions of the wood in winter. He therefore is inclined to believe, that the saccharine matter is generated by a process similar to that of the germination of seeds; and that the said process is always going on during the spring and summer; but that towards the conclusion of the summer, the true sap simply accumulates in the alburnum, and thus adds to the specific gravity of winter-felled wood, and increases the quantity of its extractive matter. He says also, that he has some reasons for thinking that the true sap descends through the alburnum, as well as through the bark; and that he has been informed, that if the bark be taken from the trunks of trees in the spring, and such trees be suffered to grow till the following winter, the alburnum acquires a great degree of hardness and durability.

Mr. Knight concludes by observing, that he conceives himself to be in possession of facts, which prove that both buds and roots originate from the alburnous substance of plants, and not, as he believes is generally supposed, from the bark.

On the Action of Platina and Mercury upon each other. By Richard Chenevix, *Esq. F.R.S. M.R.I.A.* &c. Read January 10, 1805. [*Phil. Trans.* 1805, *p.* 104.]

Mr. Chenevix, in the month of May 1803, presented to the Royal Society a paper, which was printed in the Philosophical Transactions for that year, respecting the nature of a metallic substance which had been offered to the public as a new simple metal, under the name of Palladium. In that paper he not only attempted to prove that the said substance, instead of being a simple metal, was merely a compound of platina and mercury, but he also described certain processes by which he had been enabled to produce it. He now expresses his mortification to learn that the processes he there recommended, as the least likely to fail, have been generally unsuccessful; and confesses he has reason to believe " that the nature of palladium is considered by most chemists as unascertained, and that the fixation of mercury by platina is by many regarded as visionary."

In France, he says, the compound nature of palladium has been more generally credited; M. Guyton, who was appointed by the National Institute to make a report upon Mr. Chenevix's experiments, having repeated some of them, and having been led by the results to the same general conclusions as Mr. Chenevix.

Messrs. Fourcroy and Vauquelin also made some experiments upon the subject; but as about this time a new metal had been discovered in crude platina by Mons. Descotils, the above-mentioned chemists were led to suppose it probable that the new metal was concerned in the production of palladium; and finally declared, as their opinion, that the substance called palladium does not contain mercury, but is formed of platina and the new metal of M. Descotils. Mr. Chenevix adduces several arguments to show that this opinion is not well founded; and in the latter part of his paper, he says, that

in order to ascertain the matter, he observed the methods recommended by those chemists for obtaining pure platina, but did not perceive any difference in the facility with which either kind of platina combined with mercury.

Mr. Chenevix then adverts to the experiments of Messrs. Rose and Gehlen, who attempted to repeat some of the processes described by him for the formation of palladium. The experiments of those gentlemen were unsuccessful; but this, Mr. Chenevix considers as not militating against his experiments, as he shows that the processes made use of by them, though meant to be an exact imitation of his, were, in fact, materially different. The same gentlemen, Mr. Chenevix says, seem to question his having fused platina, as they could not succeed, although they exposed it to a heat, the degree of which Wedgwood's pyrometer ceased to mark. Upon this Mr. Chenevix remarks, that they do not mention their having made use of any flux; whereas he employed borax for that purpose. He then describes, at full length, the method used by him, which consists in filling a Hessian crucible with lamp-black pressed hard together, and placing the platina, surrounded by borax, in the centre of the lamp-black, at the bottom of which there is previously formed a cavity to receive the platina when fused.

Mr. Richter also attempted to make palladium by the process which Mr. Chenevix describes as the best for that purpose, but failed. He was, however, convinced by his trials, that "mercury is capable of entering into combination with platina, so that it cannot afterwards be separated by fire."

It appears also that Mr. Tromsdorff, and likewise Mr. Klaproth, have made some fruitless attempts to obtain palladium. As these gentlemen, as well as Messrs. Rose and Gehlen, and Mr. Richter, seem disappointed at their want of success, Mr. Chenevix takes occasion to observe, that they appear to have placed a reliance upon his processes, which his words did not authorize; and says that his paper, "as far as regards palladium, is rather a narrative of fruitless attempts, than a description of an infallible process, and more likely to create aversion to the pursuit, than to inspire a confidence of success."

The compound nature of palladium, Mr. Chenevix thinks, has received some support from the galvanic experiments of Mr. Ritter, who found its galvanic properties different from what they ought to be, upon the supposition of its being a simple metal.

As a further excuse for the failure that has attended the repetition of his processes, Mr. Chenevix mentions that Prof. Lampadius, a few years ago, "in distilling some substances that contained sulphur and charcoal, obtained a peculiar liquid, which he called sulphur-alcohol; and that, after many fruitless attempts to procure the liquid a second time, he abandoned his researches. Messrs. Clement and Desormes, however, some time after obtained this liquid, but were equally unsuccessful in their numerous attempts to produce it again. In February last, Professor Lampadius accidentally discovered, and

has published, a method of obtaining the above-mentioned liquid, which never fails.

"By taking the reasoning on this subject in its widest extent, Mr. Chenevix thinks we shall be led to conclude, that metals may exercise an action upon each other, even in their metallic state, capable of so altering some of their principal properties, as to render the presence of one or more of them not to be detected by the usual methods. In this is contained the possibility of a compound metal appearing to be simple. But to prove this proposition must be a work of great time and perseverance, and can only be done by considering, singly and successively, the different cases which it contains, and by instituting experiments upon each."

As an example of the foregoing position, and to prove that mercury and platina act upon each other so as to disguise the properties of both, Mr. Chenevix states, that when a solution of green sulphate of iron is poured into a solution of platina, no precipitate, nor any other sensible change, ensues; but if a solution of silver, or of mercury, be added, a copious precipitate, in part metallic, takes place. He has tried to produce the same effect with other metals and platina, but has not observed anything similar. From this he thinks it fair to conclude, that "whenever a solution of platina is precipitated, in a metallic state, by a solution of green sulphate of iron, either silver or mercury is present. He adds, that the precipitation of a mixed solution of platina and silver, requires no further caution than to free the salt of platina, as much as possible, from muriatic acid."

Mr. Chenevix then makes some observations, which cannot well be abridged, on the precipitation of platina by mercury; but which show that "the state of oxidizement of the latter metal, as well as the acid in which it is dissolved, produce a considerable modification in the result." It then occurred to him, that "a method of uniting platina and mercury, without the intervention of any other metal, or of any substance except the solvents of these metals, might be accomplished, as in the case of silver and platina:" and he describes an experiment, which shows that when the mercury is at its minimum of oxidizement in nitric acid, the addition of green sulphate of iron is superfluous. But, on the contrary, if "mercury be raised to its *maximum* of oxidizement in nitric acid, no precipitation occurs till the green sulphate of iron is added."

Mr. Chenevix also makes a variety of observations respecting the complicated affinities which take place when the muriates of the above metals are employed. These we shall pass over, and proceed to notice those experiments which form the principal object of this paper. From the first experiment it appears, that if a solution of highly oxidized nitrate of mercury is poured into a mixed solution of platina and green sulphate of iron, a muriate of mercury is formed, and also a metallic precipitate; the former is retained in solution; the latter weighs more than the original quantity of platina, even after nitric acid has been boiled repeatedly, and in large quantities, upon it. By exposure to heat, he acknowledges that little more,

in general, is left, than the original weight of the platina; and admits that even a diminution of weight may be sometimes observed. Before the precipitate has been exposed to heat, it may be dissolved in nitro-muriatic acid more easily than platina itself.

The second experiment is to show that when a mixed solution of platina and mercury is precipitated by metallic iron, a precipitate nearly equal to the sum of the two former metals is generally obtained, the properties of which appear to be similar to those of the precipitate obtained in the first experiment.

We learn, from the third experiment, that when an amalgam of platina, formed by means of the ammoniacal muriate of that metal, according to the method of Count Mussin Pushkin, is exposed to heat, a metallic powder remains, which is soluble in nitro-muriatic acid, and affords a copious precipitate by means of green sulphate of iron.

The fourth experiment states, that if sulphur is added to the ingredients used in the formation of the above-mentioned amalgam, and the whole treated as before, the precipitate caused by green sulphate of iron is more considerable.

The fifth experiment informs us, that if sulphur is rubbed with ammoniacal muriate of platina, the mixture may be melted on a sand bath. If mercury is then added to the melted mass, and the whole exposed to a strong fire, a button remains, which, being dissolved in nitro-muriatic acid, gives a precipitate, as before, with the green sulphate of iron.

In the sixth experiment we are told, that if sulphuretted hydrogen is passed through a mixed solution of platina and mercury, and the precipitate afterwards melted with borax, the button will not contain any sulphur. Green sulphate of iron causes a precipitate in the solution of this button.

The seventh experiment serves to show that phosphate of ammonia, when added to a solution of platina and mercury, causes a precipitate, the solution of which is acted upon by green sulphate of iron.

By the eighth experiment it appears, that if the precipitate formed by adding nitrate of mercury, at the minimum of oxidizement, to muriate of platina be washed, reduced, and afterwards dissolved in nitro-muriatic acid, another precipitate may be produced by means of green sulphate of iron.

The ninth experiment relates to the action of recent muriate of tin, which Mr. Chenevix says is one of the most delicate tests in chemistry, detecting the presence of mercury. If a single drop of neutralized nitrate or muriate of mercury is put into 500 grains of water, the addition of muriate of tin causes the liquor to become turbid, and to assume a smoke-gray colour. And even if the above liquor is diluted with ten times its weight of water, the effect is still sensible. But if recent muriate of tin is poured into a solution, not too much concentrated, of platina and mercury, it can hardly be distinguished from a simple solution of platina. If, however, too much

mercury be present, the excess is acted upon as in the case of mercury, the liquor assuming a darker colour than with platina alone.

From the above experiments, Mr. Chenevix infers that mercury can act upon platina, and confer upon it the property of being precipitated, in a metallic state, by green sulphate of iron. The first and second experiments prove, he says, that platina can protect mercury from the action of nitric acid; and also that mercury increases the action of nitro-muriatic acid upon platina. The third, fourth, fifth, sixth, seventh, and eighth experiments show that mercury can combine with platina, in such a manner as not to be separated from it by the degree of heat necessary to fuse the compound. The eighth experiment proves that the action of mercury upon platina is not confined to the metallic state, but that these metals can combine and form an insoluble triple salt, with an acid that produces a very soluble compound with platina alone. The ninth experiment shows that platina can retain in solution a certain quantity of mercury, and prevent its detection by a substance which acts powerfully when platina is not present.

Mr. Chenevix admits that one or two of the above-mentioned experiments appear to contradict some of those he described in his former paper on Palladium; for in the present experiments, "platina protects mercury against the action of nitric acid, whereas in palladium the mercury is not only acted upon itself, but contributes to the solution of platina in the same acid." The discussion of these objections, Mr. Chenevix says, he shall defer to another opportunity. He also acknowledges that there is some incorrectness in his former paper, with respect to the proportional quantities of the ingredients that enter into the composition of the metallic precipitate formed by means of green sulphate of iron; and after making various remarks on that head, states the mean result to be about 17 parts of mercury, and 83 of platina, when the specific gravity of the compound was about 16.

Mr. Chenevix concludes by observing, "that he has as yet seen no arguments of sufficient weight to convince him, in opposition to experiment, that palladium is a simple substance. Nothing is more probable, he says, than that nature may form the alloy called palladium, and even form it better than we can do; and he thinks that the amalgamation to which platina is submitted before it reaches Europe, is sufficient to account for its containing a small portion of palladium." With respect to the failure that has happened in the attempts of others to make palladium, he says he is himself too well "accustomed to such failure not to believe that it will happen, even in well conducted trials;" but he considers four successful experiments, which were not performed in secret, as a sufficient answer to that objection.

The experiments above related tend, in his opinion, to confirm his former results; but he allows that he can prescribe no other means for success than perseverance; and as Messrs. Fourcroy, Vauquelin,

and Richter, have promised to continue their researches on the subject, some great and important fact must, he thinks, issue from their labours.

An Investigation of all the Changes of the variable Star in Sobieski's *Shield, from five Years' Observations, exhibiting its proportional illuminated Parts, and its Irregularities of Rotation; with Conjectures respecting unenlightened heavenly Bodies. By* Edward Pigott, *Esq. In a Letter to the Right Hon. Sir* Joseph Banks, *K.B. P.R.S.* Read February 7, 1805. [*Phil. Trans.* 1805, *p.* 131.]

Mr. Pigott, some years ago, presented to the Royal Society a paper, which is printed in the Philosophical Transactions for the year 1797, on the periodical changes of brightness of two fixed stars. The first part of the present paper consists of a series of observations made since those of the former paper, during the space of nearly five years, on one of the said stars, namely, that in Sobieski's Shield. These observations are fully detailed in various tables; and mean results are deduced from the observations given in the former paper, and from those described in the present one. The results are as follows:—Rotation of the star on its axis, 62 days.—Duration of brightness at its maximum, without any perceptible change, 9½ days.—Duration of brightness when it does not attain its usual brightness, 20 days.—Duration of brightness at its minimum, without any perceptible change, 9 days.—Ditto when it does not decrease so much as usual, 20 days.—Decrease in time, from the middle of its full brightness to the middle of its least, 33 days.—Increase of time, from the middle of its least brightness to the middle of its full, 29 days.—Extremes of its different degrees of brightness, 5th to 9th magnitude.—Mean of its usual variation, 5th to 6th magnitude.

In the second part of this paper Mr. Pigott proceeds to examine some of the other phenomena belonging to this star, particularly one which, he says, is common to most of the variables, and likewise in some degree to our sun, namely, that the times of their periodical returns of brightness are, in general, irregular. In hopes of making some discovery respecting the cause of these irregularities, or at least of assisting future astronomers to form some opinion respecting them, Mr. Pigott made a series of observations on the star here treated of, beginning in October 1795, and ending in October 1801. These observations are detailed at full length in two tables; and it appears from them, that the periodical returns of brightness are uncommonly fluctuating, and that the differences between the extremes are very considerable. Mr. Pigott then, by way of explanation, offers the following opinions and inferences.

1st. That the bodies of the stars are dark and solid.

2ndly. That their real rotation on their axes is regular, following uniform impulses.

3rdly. That the surrounding medium does, at times, generate and